Country Reports

New Zealand

1.1 Relevant Policy

In New Zealand, student performance in mathematics is above the OECD average; however, there is a significant gap between the top and the lowest performers.[1] Low levels of attainment are particularly striking among Maori and Pasifika students.[2] To ensure that a greater proportion of students would reach the National Standards for reading, writing and mathematics (as set out in the National Curriculum), the Ministry of Education has committed NZ$25 million to professional training in numeracy and literacy skills and NZ$36 million to support low-achieving schools.[3] The subsequent 2013-2018 'Statement of Intent' reaffirmed this focus on raising numeracy and literacy skills; the current key target states that 85% of students should achieve expected numeracy and literacy skills (measured according to the National Standards) by 2017.[4]

There have been a number of policies that specifically target numeracy and mathematics skills. Established in 2000, the Numeracy Development Projects (NDP) aims to improve student performance through the professional development of mathematics teachers.[5] The NDP also developed a Number Framework to help teachers and parents measure student progress.[6] The success of the NDP initiative has had a lasting impact on mathematics-related education policy. The Number Framework, for example, informed the mathematics subject area of the revised 2007 National Curriculum as well as the 2009 Mathematics National Standards.[7] Mathematics and statistics is one of the eight '*key learning areas*' that structure the 2007 revised National Curriculum.[8] In 2010, a National Curriculum for Maori-medium schools was established; this curriculum is closely related to the revised 2007 National Curriculum for English-medium schools but also incorporates traditional Maori values into its Framework.[9]

The 2009 National Standards for Mathematics set specific competencies that students are expected to achieve in three key areas (number and algebra, geometry and measurement, and statistics) for each of the eight years of compulsory primary education. These standards are aligned with the New Zealand Curriculum.[10] The aim of the national standards is to '*place a strong emphasis on students' ability to solve problems and model situations in a range of meaningful contexts by selecting and applying appropriate knowledge, skills, and strategies*'.[11] Primary-level national standards are assessed in-school by teachers, rather than through a national testing programme; the Ministry of Education has developed a number of assessment tools to support teachers.[12] National Standards for secondary and tertiary education are determined in accordance with the New Zealand Qualifications Framework (NZQF); these standards are assessed through the National Certificate of Education Achievement (NCEA) at secondary level and through relevant qualifications at tertiary level.[13]

The 2014-2019 'Tertiary Education Strategy' also identifies literacy and numeracy as a key policy area; the strategy commits to raising these basic skills among the high number of past and current school leavers that lack formal qualifications.[14] Established in 2009, the National Centre of Literacy and Numeracy for Adults plays a key role in achieving greater literacy and numeracy skills in the tertiary sector.[15] The Centre has engaged in a number of initiatives, including working closely with vocational tutors in order to support professional development and embed numeracy skills in student learning.[16]

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[1] http://www.oecd.org/education/school/49681441.pdf
[2] http://www.minedu.govt.nz/~/media/MinEdu/Files/TheMinistry/2010StatementOfIntent.pdf
[3] http://www.minedu.govt.nz/~/media/MinEdu/Files/TheMinistry/2010StatementOfIntent.pdf
[4] http://www.minedu.govt.nz/theMinistry/PublicationsAndResources/StatementOfIntent/~/media/MinEdu/Files/TheMinistry/2013SOI/StatementOfIntent2013.pdf
[5] http://www.nzmaths.co.nz/numeracy-development-projects-number-framework
[6] http://www.nzmaths.co.nz/numeracy-development-projects-number-framework
[7] http://www.nzmaths.co.nz/sites/default/files/Numeracy/References/Comp09/comp09_young-loveridge.pdf
[8] http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/new-zealand-overview/new-zealand-instructional-systems/
[9] http://www.oecd.org/education/school/49681441.pdf
[10] http://nzcurriculum.tki.org.nz/National-Standards/Mathematics-standards/Understanding-the-standards
[11] http://nzcurriculum.tki.org.nz/National-Standards/Mathematics-standards/Unpacking-the-mathematics-standards
[12] http://www.oecd.org/education/school/49681441.pdf
[13] http://www.oecd.org/education/school/49681441.pdf
[14] http://www.minedu.govt.nz/~/media/MinEdu/Files/EducationSectors/TertiaryEducation/TertiaryEducationStrategy2014/MOE_TES2014_V9.pdf
[15] http://www.literacyandnumeracyforadults.com/resources/355013
[16] http://www.literacyandnumeracyforadults.com/Resources/355132

1.2 Institutions and Courses

General System

Education is compulsory from six to 16 years of age;[17] government funding is available for preschool for children of three years of age and non-compulsory primary school for those from five years of age.[18] Compulsory school is divided into primary (Years 1-8) and lower secondary (Years 9-11); some students attend an intermediate school between primary and secondary school (Years 7-8).[19] All students may progress to upper secondary school (Years 12-13) regardless of previous educational achievement.[20] At upper secondary, students may pursue specialised vocational courses, or study vocational courses as part of a general programmes.[21] Tertiary education includes both higher (academic) and vocational pathways.[22]

The National Certificate of Educational Achievement (NCEA) is available at three levels and allows progression to tertiary education, including both higher education and further educational vocational routes.[23] These levels typically correspond to the school Years 11-13.[24] There is a wide degree of flexibility in choice of subjects; however, to achieve NCEA Level 1, students must obtain at least 10 credits (from a total of 80 credits) in subjects that fulfil the national numeracy standards determined in accordance with the New Zealand Qualifications Framework (NZQF).[25] Mathematics with calculus and mathematics with statistics are the two popular options among students.[26] While NCEA Levels 2-3 do not include any specific numeracy requirements, students cannot sit these higher examinations without having first achieved the numeracy component of NCEA Level 1.[27]

Participation rates in mathematics across all three levels has increased steadily over a 10 year period from 2003.[28] In 2011, participation in maths was reported to be 96% for 16 year olds, 84% for 17 year olds and 65% for 18 year olds.[29] Over the three years between the ages of 16 and 18, there is a shift from general mathematics to options which potentially have a more applied focus such as, for example, accounting[30] and mathematics with statistics.[31] Learners who remain within formal education demonstrate a low level of need for remedial maths: 0.6% for 16 years old, 0.54% for 17 years old and 0.06% at for 18 year olds.[32]

Vocational Courses

In addition to the NCEA, secondary schools may offer specialised vocational qualifications. These may be delivered directly by the school or in partnership with tertiary providers.[33] The National Qualifications Framework (NZQF) sets out minimum competence levels for vocational programmes consistent with the standards required for the NCEA.[34] Vocational education comprises '*only a very small part*' of student participation at upper secondary level.[35]

In 2010, 'The Youth Guarantee' was established to encourage young people to remain in education that may otherwise be at risk of dropping-out.[36] The programme offers pathways in five key sectors: Manufacturing and Technology;

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[17] http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/new-zealand-overview/new-zealand-instructional-systems/

[18] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Early_Childhood_Education.aspx

[19] http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/new-zealand-overview/new-zealand-instructional-systems/

[20] http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/new-zealand-overview/new-zealand-instructional-systems/

[21] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx

[22] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Tertiary_Education.aspx

[23] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/School_Assessment_and_Qualifications.aspx

[24] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/School_Assessment_and_Qualifications.aspx

[25] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/School_Assessment_and_Qualifications.aspx

[26] http://www.nuffieldfoundation.org/sites/default/files/files/Towards_universal_participation_in_post_16_maths_v_FINAL.pdf

[27] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/School_Assessment_and_Qualifications.aspx

[28] http://www.nuffieldfoundation.org/sites/default/files/files/NEW%20ZEALAND%20country%20profilev_FINAL.pdf

[29] http://www.nuffieldfoundation.org/sites/default/files/files/NEW%20ZEALAND%20country%20profilev_FINAL.pdf

[30] http://www.nuffieldfoundation.org/sites/default/files/files/Country_profiles_outlier_NuffieldFoundation18_04_11.pdf

[31] http://www.nuffieldfoundation.org/sites/default/files/files/NEW%20ZEALAND%20country%20profilev_FINAL.pdf

[32] http://www.nuffieldfoundation.org/sites/default/files/files/NEW%20ZEALAND%20country%20profilev_FINAL.pdf

[33] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx

[34] http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/new-zealand-overview/new-zealand-instructional-systems/

[35] http://www.nuffieldfoundation.org/sites/default/files/files/Towards_universal_participation_in_post_16_maths_v_FINAL.pdf

[36] http://www.nuffieldfoundation.org/sites/default/files/files/NEW%20ZEALAND%20country%20profilev_FINAL.pdf

Construction and Infrastructure; Primary Industries; Social and Community Service; and Service Industries.[37] All qualifications offered through this programme must embed literacy and numeracy skills into individual courses of study.[38] Courses offered include: Catering and Hospitality, Carpentry, Plumbing and Gas-Fitting, Rural Skills, Mechanical Maintenance, Computing, Electrical and Related Trades, Retail, Trades foundation, Horticulture, Office Administration and Computing, Agriculture, Automotive and Mechanical Engineering, and Forestry.[39]

Further providers of vocational qualifications at secondary level include trades academies.[40] Trades academies operate at both secondary and tertiary level to deliver courses in a range of vocational specialisms, including tourism, primary industries, building and construction, hospitality, engineering, business, computing.[41] Courses are tailored to local and national workforce needs.[42] Secondary schools are also able to purchase tertiary vocational courses for students through the the Secondary-Tertiary Alignment Resource (STAR).[43] Courses are typically non-National Curriculum and include work-based training; students pursuing STAR courses may obtain tertiary level vocational qualifications while still at secondary school.[44]

Tertiary vocational education and training may be provided by Institutes of Technology and Polytechnics (ITPs), Industry Training Organisations (ITOs), Wananga (Maori-medium tertiary institutions), Private Training Establishments (PTEs) and in the workplace.[45] Courses of study may lead to recognised certificates, diplomas, full degree programmes and , in some cases, post-graduate qualifications.[46] Qualifications may be designed and delivered in collaboration with particular industry sectors, and may include work-based training as part of the course requirements.[47]

1.3 Practice and Pedagogy

It is recognised that student achievement in mathematics is dependent upon the provision of high quality teaching.[48] To support '*effective teaching and learning in mathematics*', the Ministry of Education set identified seven key activities that constitute best practice for mathematics teachers:[49]

- An inclusive classroom climate
- Focused planning
- Problem-centred activities
- Responsive lessons
- Connections (connecting maths with real-life examples)
- High expectations
- Equity

The aim of these activities is to reinforce the idea that teachers should focus not only on understanding the relevant mathematical concepts for themselves, but also on recognising the different ways in which students learn and the conceptual difficulties that students may encounter in the study of mathematics.[50] These activities are based upon the findings of the Numeracy Development Projects (NDP).[51] An assessment of the NDP programme also found that success rates were highest amongst teachers that took a positive attitude to professional development and adapted their teaching methods in response to the training provided.[52] The teaching and learning approach adopted in mathematics is consistent with New Zealand's wider pedagogical policy: namely, to '*moving to an instructional focus on*

[37] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx
[38] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx
[39] http://www.nuffieldfoundation.org/sites/default/files/files/NEW%20ZEALAND%20country%20profilev_FINAL.pdf
[40] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx
[41] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx
[42] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx
[43] http://www.nuffieldfoundation.org/sites/default/files/files/NEW%20ZEALAND%20country%20profilev_FINAL.pdf
[44] http://www.nuffieldfoundation.org/sites/default/files/files/NEW%20ZEALAND%20country%20profilev_FINAL.pdf
[45] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx
[46] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx
[47] http://www.minedu.govt.nz/NZEducation/EducationPolicies/InternationalEducation/ForInternationalStudentsAndParents/NZEdOverview/Technical_and_Vocational_Education.aspx
[48] http://nzcurriculum.tki.org.nz/National-Standards/Mathematics-standards/Effective-mathematics-teaching
[49] http://nzcurriculum.tki.org.nz/National-Standards/Mathematics-standards/Effective-mathematics-teaching
[50] http://nzcurriculum.tki.org.nz/National-Standards/Mathematics-standards/Effective-mathematics-teaching
[51] http://www.nzmaths.co.nz/numeracy-development-projects-number-framework
[52] http://numeracydb.nzmaths.co.nz/Numeracy/References/Comp06/comp06_ell.pdf

student engagement rather than on only dissemination of content'.[53] The Ministry of Education has also funded the development of online resources to support the teaching and learning of maths skills.[54]

New Zealand's Tertiary Education Commission (TEC) has developed a strategy to improve numeracy skills among vocational students.[55] The strategy paper identifies areas of good practice that have been shown to increase students motivation and contribute to a higher number of students pursuing additional numeracy qualifications alongside their vocational courses.[56] These include embedding numeracy into the curriculum using real-life examples, especially those that pertain the to the workplace, and encouraging tutors to work as a team in order to plan and deliver numeracy skills across course curricula.[57] An observational study investigating the teaching of literacy, numeracy and language (LNL) in 15 tertiary institutions across New Zealand focused on existing trends in teaching practice.[58] Teachers were observed to have a positive, committed approach to teaching; however, most teachers '*talked more than learners*' in the classroom and questioning was often limited to '*closed*' questions rather than open questions that would facilitate further debate among leaners.[59]

Further small-scale initiatives have also been established to help support vocational learners in developing numeracy skills. Tutors at the Te Whare Wananga o Awanuiarangi, for example, engaged a well-known Maori television personality, Matua Parkinson, to act as mentor for young (Maori) learners studying for vocational qualifications in Building, Carpentry and Associated Trades Services.[60] Parkinson discussed his difficulties in learning core numeracy skills with the students on the courses and worked with them in a number of theory sessions. The levels of student engagement were seen to improve dramatically.[61] The team identified a number of critical success factors in the success of the intervention: adopting a Maori worldview so as to empathise with learners and increase the relevance and effectiveness of communication; working with a role model who adopted a very direct approach in a face-to-face dialogue couched in the language of young males; and developing a high trust environment in which effective team working in small groups was possible.[62]

A further initiative developed by the agricultural science tutor, Ken Payne, at Telford Polytechnic required students to apply mathematical formulae to help solve real-life calculations integral to farming.[63] The aim of the 'Speights Stubby Grass-ometer' initiative was to demonstrate how mathematical accuracy was essential to determining the viability of certain business practices; in this case, calculating the length of time that cows can graze in a field.[64] A 'grassometer' (adapted from a beer bottle) is used to take a number of measurements of the height of grass, to give an estimate of food yield of the field.[65] A formula is then used that takes account of the number of cows per hectare, the estimated food yield per hectare, and the average daily consumption of the cows in order to work out how many days of grazing there is in a particular pasture before the cows have to move on in order to leave the pasture healthy and not overgrazed.[66] The initiative required students to make use of skills required at Levels 5 and 6 of standard numeracy progression frameworks and to embed that practice in the course through the use of a contextualised, workplace example.[67]

1.4 Key Points of Learning

The Numeracy Development Projects (NDP) aims to improve student performance through the professional development of mathematics teachers. The NDP also developed a Number Framework to help teachers and parents measure student progress. The success of the NDP initiative has had a lasting impact on mathematics-related education policy.

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[53] http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/new-zealand-overview/new-zealand-instructional-systems/
[54] http://www.studyit.org.nz/about.html
[55] https://ds.unitec.ac.nz/dsweb/Get/Document-559/Acad+02c_4+Embedding+Literacy+and+Numeracy.pdf
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[59] http://www.minedu.govt.nz/~/media/MinEdu/Files/EducationSectors/TertiaryEducation/ObservationalStudy.doc
[60] http://www.literacyandnumeracyforadults.com/resources/355162
[61] http://www.literacyandnumeracyforadults.com/resources/355162
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[67] http://www.literacyandnumeracyforadults.com/resources/355111

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